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HRPP 428

Coastal defences: social utility, imagination and justice

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Reproduced from a paper presented at:
Coasts, Marine Structures and Breakwaters 2009 Conference
EICC, Scotland
16-18 September 2009

COASTAL DEFENCES: SOCIAL UTILITY, IMAGINATION AND JUSTICE

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Abstract

New methods are being developed for the assessment of the condition of Flood and Coastal Erosion Risk Management (FCERM) defence systems in relation to their likely engineering performance and consequent fragility. However, it is being increasingly acknowledged that, in addition to their FCERM engineering utility, coastal defence systems can offer significant amenity and aesthetic value and contribute to wider 'quality of life' objectives. However, this can pose a challenge when seeking to deliver solutions which meet the requirements for flood and coastal defence but are also socially just. This paper sets out a theoretical framework within which these issues can be understood, drawing on literature and on interviews conducted by the author both with coastal engineering practitioners and with community members and activists. The framework – a trinitarian blend of Order, Imagination and Justice (Gorringe, 2002) – reflects both Vitruvius' architectural principles (strength, utility and beauty) and insights drawn from key thinkers in sociology, psychology (Maslow) and philosophy. The paper sets out some initial thinking on how this framework might be applied in practice by engineers and what kinds of features might be important to include in designs.

At the previous ICE breakwaters conference, Cruickshank *et al* (2005) presented a paper on their experiences with the design of a housing development on the south coast of England. In this, they reflected on the challenges of trying to integrate engineering and architectural thinking in the design of coastal defences. The present paper seeks to build on these earlier reflections. As well as examining various theories that might be used as the basis for inclusion of social dimensions in our engineering design, it draws on research data gathered in semi-structured interviews with both coastal residents and engineering practitioners.

Introduction

Flood and coastal risk management (FCRM) is a concept which differs from flood and coastal defence in its recognition within the UK context of the infeasibility of protecting against all flood and coastal risk without excessive expenditure. This has drawn closer attention to the engineering performance of defences and defence systems and the need to understand their strengths and weaknesses as part of an overall system. It has led, for example, to the introduction into flood systems analysis of fragility curves (Dawson & Hall, 2002, Hall *et al*, 2003; Simm *et al*, 2006; Simm *et al*, 2008), condition dependent curves which describe the increasing likelihood that a defence will breach (fail structurally) as load increases. In addition to avoiding structural failure, a defence must also perform in a predictable manner in the way it causes waves and sediment to respond. An important example of such a response is wave overtopping, for which tools have been developed to assess the quantity of water likely to overtop and assess the impact on flooding and on human safety (Pullen *et al*, 2007).

These aspects emphasise the engineer's primary responsibility to the citizen for health and safety. The ICE (2004) captures

this responsibility in the third rule of their Code of Professional Conduct:

"*All members shall have full regard for the public interest, particularly in relation to matters of health and safety, and in relation to the well-being of future generations*."

Similarly the first canon of the American Society of Civil Engineers code of ethics (ASCE, 2006) states:

"*Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties*."

In this regard it is of note that the engineering profession still regards itself as ultimately working for 'citizens' or the 'public', despite the fact that its clients under contract may well be specific customers or customer organisations. Indeed, embedded in the wording of these codes is a much broader implication which extends well beyond the scope of health and safety legislation into the whole area of the public interest and well-being and seeking sustainable development. (Sustainable development has many definitions but there is general recognition of the need to uphold the three pillars of the economic, environmental and social needs of present and future generations.)

How then should we think about and address the broader social issues of coastal engineering structures? One starting point is that offered by psychologist Abraham Maslow (1943, 1954). Maslow proposed a hierarchy of human needs (Figure 1). His idea was that basic human needs had to be met before 'higher' needs such as personality growth could be met. The engineering profession clearly has a significant role to play in ensuring security of supply of basic needs, such as food, water, shelter and clothing has to be met first. The provision of flood and coastal defence comes into this category (with the caveat already articulated above that protection against all extreme events is not feasible.)

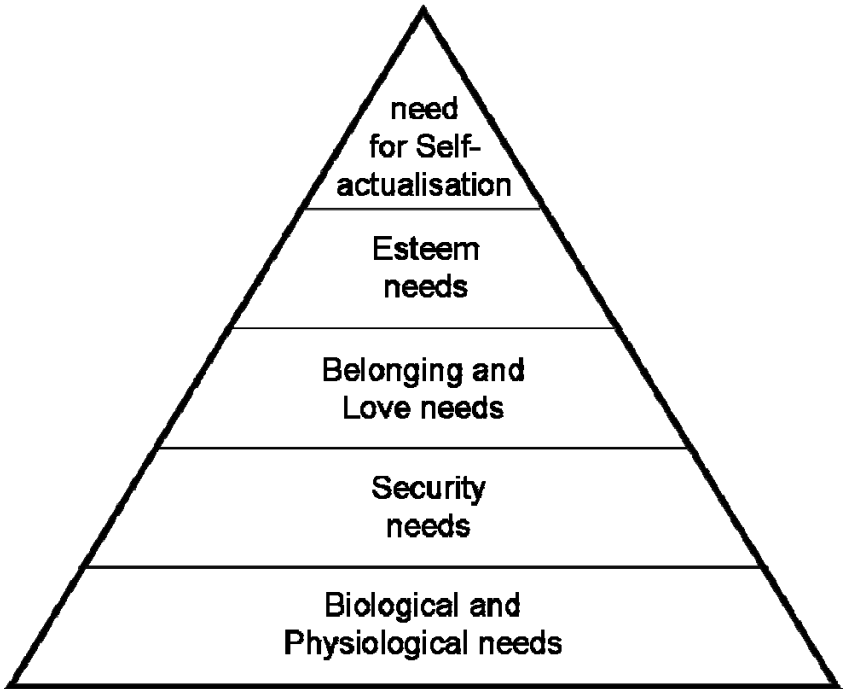

Figure 1 Maslow's hierarchy of needs. Lower parts of the hierarchy must be satisfied before higher parts

Table 1. Example requirements for waterfront developments (after Cruickshank *et al*, 2005)

Architectural (*utilitas/venustas*) aims	Engineering (*firmitas*) aims
Providing free and inviting access and egress to the beach	Preventing wave and overtopping ingress into the development
Ensuring sightlines to the sea were maintained	
Ensuring close contact with the sea without large level changes	
Using soft landscaping to improve the aesthetics	Using resilient materials that will stand up to the design conditions.

Strength, utility and beauty

The question then arises at to whether coastal structures provide any value at the higher levels in Maslow's hierarchy (or indeed if to meet these higher needs would be in conflict with the provision of any other biological, physiological or security needs). The classical starting point for thinking about these issues has been the architectural principles of Vitruvius: *firmitas*, *utilitas*, and *venustas*. Whilst these are often remembered in the words of Sir Henry Wotton's (1568 - 1639) translation as "commodity, firmness and delight", it is probably easier to think of them in terms of *strength*, *utility*, and *beauty*. Gwilt (2007) translates Vitruvius thus: "*Strength arises from carrying down the foundations to a good solid bottom, and from making a proper choice of materials without parsimony. Utility arises from a judicious distribution of the parts, so that their purposes be duly answered, and that each have its proper situation. Beauty is produced by the pleasing appearance and good taste of the whole, and by the dimensions of all the parts being duly proportioned to each other*."

Vitruvius' threefold characterization has been challenged over the years, particularly by Western architects in the period 1910 to 1960. However, as Leyland Roth (2007, 67) explains, since about 1965, there has been a renewed recognition that "*there can be an independent quality of delight in architecture and that the most esteemed architecture endeavours to produce the greatest pleasure for the price, with function and durability being satisfied as well*."

The discussion in Cruickshank *et al* (2005) focuses on the interplay between the *firmitas* aims on which the coastal engineer focuses and the *utilitas* and *venustas* requirements on which the architect focuses (see example in Table 1), but without particularly distinguishing between these two forms of architectural aim.

Perhaps Vitruvius' categorization can be interpreted in the context of coastal defences in the following way:

1. Firmitas (strength) expresses the functional value of the assets to deliver their principal engineering function, particularly in the extreme events for which they must necessarily be designed. Here communities/publics are expected mainly to be concerned about the protection that the assets offer from flooding and erosion events, but clearly they will also want to be assured that the assets are also structurally fit for purpose for any recreational or other social function.

2. Utilitas (utility) relates to the features of the assets when being routinely used by the public in various ways. Here their amenity, health, safety, etc will be important during regular use for walking, playing, relaxing etc. Here issues of usability, convenience, etc. become important. Alexander *et al* (1978) suggested a number of examples of

wider public utilitarian factors to the author:

- Pedestrian walkways and road crossings
- Cycle paths
- Facilities for children; adventure places
- Facilities for the old and disabled
- Arrangements to allow people to safely use (parts of) the area at night
- Public 'outdoor rooms'
- Provision for animals and pets
- Places to sit and to sleep
- Walls suitable for sitting on.
- Places for summer awnings to provide shade etc.

A good illustration of such factors emerged when one engineer interviewee highlighted different ways in which publics value rock groynes: "*I tell you what rocks are for: Sunbathing. They are massive storage heaters, they warm up … and … they stay warm into the evening, so you can sit on them and keep warm…*" He also commented: "*What we [engineers] don't like, the people do like … - lighting barbecues amongst the rocks*."

3. Venustas (beauty) is taken to encompass all the positive aesthetic values and symbolic meanings which individuals and communities attach to the defences. These might include for example:

- Hard landscaping
- Green spaces and garden features, raised planted beds
- High places from which people can view the sea and landscape
- Promenade, with associated points of attraction at each end and clusters of eating places and small shops
- Places to perform music etc from (e.g. bandstands) linked to the promenade

In relation to this category the engineer commented: "*Groynes and outfalls and things like that are things that people like to walk out on. Whether they should or whether they shouldn't is another matter, but they do like to walk out on them. And I mean, we're a strange nation, we like to walk out on piers and get out, don't we*."

Aesthetics: appealing, 'living' coastal designs

In Maslow's hierarchy of human needs, aesthetic aspects are evidently associated with the 'self-actualisation' need. Maslow's concept of the need for self-actualisation is broad; later writers define it more narrowly as 'personal growth and fulfilment' and consciously separate out from it cognitive needs (knowledge, meaning, self-awareness) and aesthetic needs (beauty, balance, form, etc). But all these aspects touch on that intangible 'something' which turns purely functional structures into things of beauty or of inspiration.

One of the most useful authors who can assist with understanding why certain structural configurations may be more appealing than others is architect Christopher Alexander. In a development of his previously published pattern language theory and practice (Alexander *et al*, 1978), Alexander (2004) encourages implementation of 'living' systems for buildings and town plans, based on fifteen geometric properties which are also seen in nature. These concepts are based around the idea of *centres*. A *centre* is a visually observable feature that can be seen to have a clear identity, even if linked to other centres or embedded hierarchically within other centres. The geometric properties are:

1. Levels of scale
2. Strong centres
3. Boundaries
4. Alternating repetition
5. Positive space
6. Good shape
7. Local symmetries
8. Deep interlock and ambiguity
9. Contrast
10. Gradients
11. Roughness
12. Echoes
13. The void
14. Simplicity and inner calm
15. Not separateness (connectedness)

Discussing the full implications of his ideas for coastal engineering is beyond the scope of this paper. However, a few examples can be given:

Levels of scale: To intensify a given centre we need to make another center perhaps a half or a quarter the size of the first. If the smaller one is less than one tenth of the larger one it is unlikely to help it in its intensity."(*op cit*, p.149). Timber groynes may offer this kind of hierarchy of scales (Figure 3).

Alternating repetition: Alexander speaks of a rhythm of the alternating centres interlocked with a second system of centres working in parallel - a kind of alternating repetition or oscillation that is needed. Such alternating repletion can be seen in alternating groyne fields where short and longer groynes alternate with one another; arguably this is more attractive than fields where all the groynes are the same length. However, the same kind of effect can be achieved by means of alternating large structures such as fishtail groynes or detached breakwaters with curving bays of sediment. These emulate natural headland to bay crenulations along some parts of our coast. The recent seawall layout at Blackpool also exhibits this feature.

Roughness (irregularity or randomness) in otherwise symmetric or regular patterns is a key feature that makes structures appear to 'live' and Alexander argues that this "is an essential feature of living things" (p211). Whilst appropriate roughness is not at the expense of "careful guarding of the essential centres in the design", it may be necessary to deliberately include some randomness in spacings of structural elements or between structures in a system. In engineering terms, this would mean providing setting out information which embedded this, being careful to make sure it did not end up simply looking like poorly controlled construction!

The implication of this is that our response in terms of what we build has to be sympathetic as far as possible to what people already find attractive. The challenge here is that there is a wide diversity of opinion; what one person may find attractive in structural form and layout, to another is unattractive. ECUS (2003), for example, in their guidelines on Guidance for coastal defence in relation to their landscape and visual impacts prepared for the Countryside Council for Wales laid great stress on moving towards broad open landscapes and the absence of groyne fields. However, these exist in many places around our coasts without people finding their rhythmic patterns unattractive. Indeed, to a number of artists, such as Paul Nash (Cardinal, 1989) they seem to be quite appealing.

Figure 3 Timber groynes, showing levels of scale

In reality of course people do not generally analyse the beauty of structures or scenes things for their structure but operate at a much more intuitive level; this is why Alexander encourages people to think about whether they believe designs are 'living' or not. The coast is generally seen to be 'living' and therefore attractive to most people. The author's interviewees invariably focussed on this attractiveness:

"*Being an island race, we always have a fondness for the sea. And I don't know that when all of us retire, we would all move to the sea, but there is a good percentage that think 'Wouldn't it be nice to have a little house on the coast'.*"

"*If you get a really hot period in the summer, the 'world and his wife' want to come to the beach.*"

Some drew out a more focussed aesthetic, perhaps even spiritual, dimension

"*Yes, our coast is much photographed, much painted and much used for artistic purposes, either the natural features of the coast or the man-made features or the human activity on the coast. It's very, very strong in people's psyche in the area, and they come here specifically to photograph or paint here. See it; feel it.*"

"It is something almost spiritual, the water and the sea. It's something to do with isolation as well, you know. The bits of coastline and the places I love the most are those which are wild and isolated."

The missing link: structures that help people belong

Whilst the foregoing discussion of some aspects of the social features of coastal structures is interesting, it would remain incomplete, however, were only Vitruvius' categorisation to be used. For, in the author's view, only considering strength and utility on the one hand and beauty on the other hand seems to omit the middle group of human needs from Maslow's hierarchy – those relating to belongingness and esteem. To this issue we must now turn.

On the face of it, needs for belongingness and esteem may not seem to be related to engineering structures. In fact, on closer examination, they are strongly linked. This is because a 'community' of people cannot be divorced from the 'place' in which they exist, including, for example, the sea defences of a coastal town. Diane Warburton (1998, p17), for example, argues that whilst community may be seen to be mainly to do with relationships between people, it is also to do with relationships between people and the place in which they are located. Ruth Liepins (2000), commenting on the work of social theorists Harvey and Massey, notes that "'*community' and 'place' are two concepts that are constantly intertwined in highly complicated ways. Communities may not be primarily identified according to their coincidence with particular places … Nevertheless, communities involve social relations that occur transiently or continually in both places and spaces*." Psychologists McMillan & Chavis (1986, 15), in their classic research on the concept of the "psychological sense of community" first postulated by Seymour Sarason (1974), found that included amongst the various components which were important to people in helping them to 'belong' to a community (such as emotional safety and sense of identification) were the boundaries and common symbol system associated with physical features, the physical and intangible features tending to interact with one another in a self-reinforcing way. Welsh national guidance on landscape character assessment, suggested the following specific connections:

- Symbolic features which reflect what is culturally important. This can include things which reflect or engender community boundaries, emotional safety, and distinctiveness/familiarity (Cohen, 1985; McMillan & Chavis, 1986; Puddifoot, 1995).
- Portrayals of historical or pre-historical/archeological associations.

- Reflections or accommodations of interest in or associations with habitat, flora and fauna. Strong socio-ecological associations may exist, e.g. with fishing, bird watching.

Philosopher Heidegger (Inwood, 1997, 33-35) tries to make sense of this connection. Engineering works are like all objects in our world; they start as what Heidegger calls *objects of use*, connected to human purposes. In other words, we might say, 'This sea wall is to defend from flooding or erosion; and the wave return wall is to turn back wave crests as they rise.' From an architectural point of view, Heidegger's objects of use category could be seen to embrace both of the Vitruvian categories *firmitas* and *utilitas*.

But Heidegger points out secondly that objects do also end up referring to each other and thus constitute a *realm of significance*, one which includes both the direct human environment in which we operate at any time and also the wider realm of our existence. The idea of a realm of significance for human action has also been picked up by sociologists. But Bruno Latour (2005, p75) in his description of Actor-Network-Theory, argues that sociologists often view objects from too narrow a viewpoint, one which merely assumes that they 'determine' human action (as in Marxian sociologies) or serve as a 'backdrop for human action' (as in interactionist sociologies). Latour points out that objects, in our case coastal defences, might also "authorise, allow, afford, encourage, permit, suggest, influence, block, render possible, forbid and so on" and thus directly participate in social interactions. Heidegger's idea of how the way we experience objects socially in time and space can be very approximately summarised as having three aspects (Inwood, 1997, 33-35):

- Experience of the spatial suitability of an object in itself and in its relationship with other objects and users ('Is the sea wall the right size and in the right place for our engineering purposes? Is it suitable for sitting on? Can you see the sea over it?')
- Experience of spatial relations between objects expressed in terms of time. (The distance from the car park to the sea wall is a few seconds. It is ten minutes walk to the town centre. Going to London will take two hours.)
- Understanding of the relation of objects back to past events and to uses that will be made of them. (Past events might include the damage the ship made to the seawall, the pictures painted at the scene. Future significance might include, say, a barbeque planned in the shelter of a groyne or a film planned to be shot along the seawall.)

Whilst, as Heidegger points out, objects are not continually noticed and they are generally inconspicuous and unobtrusive, there are various situations in which they come to prominence. Situations (*after* Latour, 2005, 80-82) in which the 'momentary visibility' of objects is clear enough to trace their social role include (interpreting Latour's ideas from a coastal engineering perspective):

- during the design phase, when social interaction is involved in agreeing function and form, and
- during extreme events and accidents, when the effect of potentially hazardous or hazard-creating structures increases risk to human health safety and welfare.

However, in his list of situations, Latour seems to fail to discuss 'ordinary', everyday engagements with objects. (It is hoped that the planned participatory studies in this research will give some insight into this aspect.)

Connectedness with structures, justice and communication

A strong and positive connection between people and our engineering structures is only likely to arise if we act in a *socially just* way in creating and managing these structures. Social justice, in general terms,

is concerned with how benefits are distributed amongst people and, as David Miller (1999, 26-32) explains, there are at least three different principles which might be applied to the distribution of benefits:

- Distribution according to need – an approach associated with communities where people share a common identity as members of a stable group with a common ethos. (Disabled or homeless people would be well-served under this approach);
- Distribution according to desert – an approach relevant where people relate to one another in utilitarian way, i.e. they have aims and purposes that can best be realised by collaboration with others; and
- Distribution on the basis of equality – an approach relevant when considering citizenship.

In coastal communities there may be elements of all three of these principles either sought or operating. If the specifics are to be elucidated and applied in practice in a particular case, then it is essential that there is good *communication* between all parties and particularly between professionals and citizens of the community. Such communication is, of course, also essential for the satisfaction of esteem needs of citizens identified by Maslow (Figure 1). But communicating sufficiently well to achieve movement of thinking in a common direction can be a major challenge. Perhaps, as engineers Valero & Vesilind (2007) point out, the problem is that in a desire to take our professional responsibilities seriously we risk "condescension and underestimation of the 'common sense' and problem solving abilities of those outside the profession". They cite a 1965 Bob Dylan lyric:

"*You don't need a weather man to know which way the wind blows.*"

How could the necessary communication to achieve socially just solutions be carried out? Simm & Samuels (2006) evince arguments that coastal engineers should develop skills in listening to and telling *stories* to help both understand citizen experiences, views and requirements and to communicate their own ideas. As one of the coastal manager engineers interviewed by the author, who had developed such skills, put it: "*There are people who live along the beach who are by no means engineers but having lived there for thirty years, they've got a fairly good idea of how coastal processes work. They possibly don't know all the terminology and some of the fine detail about storm surges, for instance, but they have a pretty good understanding of what goes on.*"

A significant issue can be that those who are affected by engineering works may feel that they have no 'voice' to express their views. This may be because they are unwilling to talk or feel themselves to be incapable of expressing their concerns in a way that professionals can understand. When communication with such people breaks down, the impact can be considerable. One interviewee from an operating authority described a typical situation:

"*There were a couple of issues with individuals where they had basically been left out of the communication loop from the beginning because of the strange way their property was. The homework that was done at the beginning wasn't thorough enough to pick up that the garden across one side of the lane belonged to that house, so the householder never got contacted about the plans until a later stage. And she was most unhappy about that and expressed it quite vociferously. And actually we ended up having to put quite a lot of time and effort into [talking to her], because it got a bit personal with the chap on the site.*"

Good example of communication were also found by the author but there was a tendency amongst professionals to adopt a 'knowledge deficit' model of public engagement; under which it is assumed that anyone who contests professional judgement is *only* doing so out of ignorance of some aspect of coastal engineering. Even

if this mindset is present, solid persistence by professionals in communication can pay dividends:

"*a retired headmistress … had a mind that could deal with information … she only came to visit a couple of times and when I told her something, [she understood] most of it but [she came] back and [got] a bit more information to try and complete the picture … And then the following year in the spring we held a public forum … [and] this lady was there and there was a chap from along the beach here who came in and … he had one or two strange ideas … and before I had a chance to answer this lady who I had been speaking to butted in and just dealt with it all because she'd understood the whole process as to what was going on and why we were doing things and so forth. … a really good example of taking the time to educate people if you like, you don't know who they're going to go and talk to – you know they will be talking to some of their friends and neighbours and so forth and there are always going to be some people who live here who would be too timid or whatever to come here and find out for themselves, but they're quite happy to talk to their neighbours and say oh yes now I understand, so it's one of those.*"

Framework for social features

Drawing together the threads of the preceding section, the framework articulated in outline by theologian Timothy Gorringe (2002) appears to be particularly helpful. In his 'Theology of the built environment', he addresses a subject that has been largely neglected by many other theologians. He argues (*op cit*, p49) for a "Trinitarian mapping of spatiality", using keywords of Imagination, Order and Justice. Evaluating his 'mapping', it seems clear that the framework both embraces and has resonances with the various insights described above:

- The idea of Order ('*God the Creator … brings order out of chaos*') captures a strong theme in Vitruvian and subsequent architectural thinking, embracing both the needs for appropriate strength (*firmitas*) and utility (*utilitas*). The concept of order can also be seen to embrace the issues of hierarchies of scale, spatial interrelationship and appropriateness for use which have been seen to be so important by such diverse writers as Alexander (2004) and Bartuska (2007) and Heidegger (Inwood, 1997).
- The idea of Imagination ('*God the Holy Spirit … is the inspirer of … visions of a better human environment*') captures the Vitruvian principle of beauty (*venustas*) and many of the ideas embedded within landscape character assessment and what Alexander (2004) sees as 'natural' principles for architecture. It also embraces ideas of symbol and emotional attachment and the way that the coastal and river environment has inspired artists, poets and writers.
- The idea of Justice ('*God the Reconciler takes flesh in order to teach peace to the nations*') provides the missing link suggested by the hierarchies of Maslow and his successors. Gorringe is keen to emphasise that the Order he conceives is no 'Stalinist central planning', but one which emerges from a '*God who loves in freedom*' and which is therefore much more akin to a consultative process (*op cit*, p48). He recognizes that 'alienation, domination and reconciliation can all be and are expressed in the built environment.' The built environment should be the place 'where social justice is, quite literally, made concrete' (*op cit*, p. 49) so that people feel they belong and are not alienated. Difference and conflict cannot be avoided, but they should be harnessed creatively in humility and hope.

Extending Gorringe's ideas, the author has created a framework making use of the symbol of the Celtic Cross (Figure 2) – appropriate given that it symbolises a holistic view of life (Silf, 2001; Bryce, 1995)

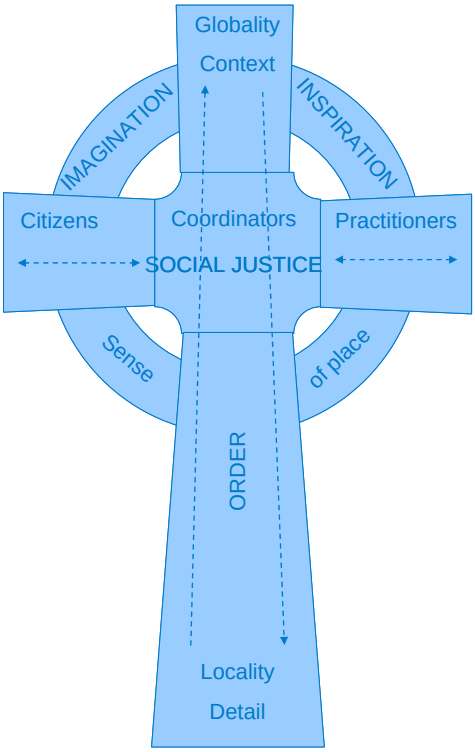

Figure 2 Model of social features of FCERM assets

The vertical *axis-mundi* in Figure 2 represents Order being achieved, simultaneously respecting general principles of engineering design in delivering environmentally sympathetic form and function but mediating these into local solutions with due respect for the needs of local communities. The horizontal axis represents the tension of achieving Social Justice, working through disagreement and conflict through engagement to bring reconciliation and connection ('sense of belonging') to communities through their coastal defences. The wheel or circle, which in the Celtic cross traditionally indicates glory or the spiritual dimension, represents the Inspiration dimension, reflecting the aesthetic and the intangible value associated with assets.

Valuation of social features

The valuation of the benefits of social features has not yet been explored in the research. However, it is clear that there are significant intangible benefits /cost savings associated with the avoidance of conflict, improved personal and community health and welfare, the provision of tourist facilities and enhancement of local culture. Valuation of these could potentially be carried out using Contingent Valuation Methods (Penning Rowsell *et al*, 2005). However, these tend to restrict thinking to a rather individualistic view and alternative approaches which reflect on broader community enhancements (e.g. of health and leisure provision) may be needed. The author is therefore not minded to attempt to set economic benefits against many of these features, but hopes to be able to identify a semi-quantitative scoring scheme (on a 1 to 5 scale) for evaluating these social features.

Conclusion

A theoretical framework of Order, Imagination and Justice (Gorringe, 2002) has been proposed within the social features of coast defences. The framework (derived from theology) has been triangulated from considerations of philosophy, Maslow's psychology of human needs and Vitruvian

architectural principles and is starting to be validated from interview material gathered by the author. The paper has also sets out some initial thinking on how this framework might be applied in practice by engineers and what kinds of features might be important to include in designs. In practice the details of such social features will have to be established in conjunction with the relevant local community, whilst seeking to create or retain appropriate responses to basic flood risk management security needs.

Acknowledgements

This paper has been prepared as part of PhD research by the author at Nottingham University. The support of supervisors Dr Michael Mawdesley, Dr Susanne Seymour and Prof. Colin Thorne is much appreciated, as is the doctoral training funding from the Engineering and Physical Sciences Research Council.

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